

## CLAIMS

54B A1

1. Apparatus for removing broken-out pieces, in particular waste portions, from a sheet of material which contains blanks or the like flat portions and which rests on a female die or the like breaking-out surface in such a way that the broken-out portion extends over an opening in the breaking-out surface and is urged away through the opening under the pressure of at least one breaking-out tool, wherein associated with the breaking-out tool is a support means which is movable in the direction of movement of the breaking-out tool and which projects into the opening and which in the rest position engages in substantially parallel relationship under the waste portion or broken-out piece disposed in the sheet of material and which is adapted to be variable in its position upon the movement of the waste portion by the breaking-out tool and in particular is adapted to be transferred into an angle of inclination relative to the sheet of material in the downward movement of the waste portion, characterised in that the support means is formed by a support tool (20, 20<sub>a</sub>, 20<sub>b</sub>, 20<sub>e</sub>, 20<sub>f</sub>, 20<sub>n</sub>; 21; 34<sub>a</sub>; 62; 66, 66<sub>a</sub>; 68; 70; 72, 72<sub>a</sub>, 96) which is rigidly connected in positively locking relationship to the breaking-out surface or female die (14) in the edge region of the opening (16, 16<sub>a</sub>) and is provided with a contact or support surface (24, 25, 34<sub>b</sub>; 64) which can be inclined with respect to that connection pairing (27, 28, 29, 31; 63, 65).

2. Apparatus as set forth in claim 1 characterised in that the connection pairing comprises at least one undercut receiving groove (28) in the female die (14) at the edge of the opening (16) thereof on the one hand and a coupling bar or rib (27) which can fit thereinto on the other hand.

3. Apparatus as set forth in claim 1 characterised in that the connection pairing comprises at least one undercut receiving groove (31) in the support tool (20<sub>n</sub>) on the one hand and a coupling bar (29), which can be fitted into the receiving groove, on the female die (14) at the edge of its opening (16) on the other hand.

4. Apparatus as set forth in claim 2 or claim 3 characterised in that the receiving groove (28, 31) and the coupling rib or bar (27, 29) extend in the breaking-out direction (x).

5. Apparatus as set forth in one of claims 2 through 4 characterised in that the cross-sections of the receiving groove (28, 31) and the coupling rib or bar (27, 29) are of a dovetail-shaped configuration.

6. Apparatus as set forth in one of claims 1 and 2 or 4, 5 characterised in that the support tool (20) is an angle portion with at least one coupling rib (27) which is formed out of its one limb (22) and with another flexible limb (24) which forms the support surface (25).

7. Apparatus as set forth in one of claims 1 and 3 or 4, 5 characterised in that the support tool (20<sub>n</sub>) is an angle portion with at least one vertical groove (31) formed in a limb (22), and with another flexible limb (24) forming the support surface (25).

8. Apparatus as set forth in claim 1 characterised in that the connection pairing comprises at least one receiving groove (28<sub>a</sub>, 28<sub>b</sub>) in the female die (14) at the edge of the opening (16) thereof on the one hand and a portion (80, 92, 97), which can be fitted into the receiving groove, of a vertical limb (22) of the support tool (20<sub>e</sub>, 20<sub>f</sub>, 21) on the other hand.

9. Apparatus as set forth in claim 1 or claim 8 characterised in that the support tool (20<sub>e</sub>, 20<sub>f</sub>, 21) is an angle portion with at least one vertical limb (22, 97) and another flexible limb (24) providing the support surface (25).

10. Apparatus as set forth in one of claims 1 through 8 characterised in that the support tool or the angle portion (20, 20<sub>e</sub>, 20<sub>f</sub>, 20<sub>n</sub>, 21) is formed from a limitedly flexible plastic material.

11. Apparatus as set forth in claim 8 or claim 9 characterised in that the flexible limb (24) forming the support surface (25) has an edge opening (32) which is delimited on both sides by cantilever portions (34), and at least one inner opening (30) at a spacing in relation to the edge opening (32).

12. Apparatus as set forth in one of claims 8 through 11 characterised in that formed on the vertical limb (22) is at least one pin-like plug-in element (80, 92) which extends or extend at a spacing (y) relative to the vertical limb and which is respectively adapted to be inserted into an opening (84, 94) provided in the female die (14) at a spacing (y) relative to the receiving groove (28<sub>a</sub>).

13. Apparatus as set forth in claim 12 characterised in that the plug-in element (80, 92) and the opening (84) are of rectangular cross-section and/or that the plug-in element (80) projects from a transverse web portion (82) at a spacing (y) relative to the rear surface of the vertical limb (22).

14. Apparatus as set forth in claim 12 or claim 13 characterised in that the plug-in element (22) projects up from a transverse web portion (82) at a spacing (y) relative to the flank surface of the vertical limb (22).

15. Apparatus as set forth in one of claims 1 through 14 characterised in that the flank surfaces (88) of the vertical groove (28<sub>a</sub>, 28<sub>b</sub>) are stepped and the vertical limb (22) is supported in the rear region (90) of the vertical groove, which rear region is of narrower cross-section.

16. Apparatus as set forth in one of claims 8 through 11 characterised in that the vertical limb (97) is connected with a coupling pairing (98/102) to a limb (100) of an angle bracket (102), which extends in the vertical groove (28<sub>b</sub>), while the other limb (101) of the angle bracket is connected to the female die (14).

17. Apparatus as set forth in one of claims 1 through 7 characterised in that arranged downstream, in the breaking-out direction (x), of the limb (24) forming the support surface (25) is at least one catch finger (38), in particular a pair of catch fingers.

18. Apparatus as set forth in claim 7 or claim 17 characterised in that the limb (24) forming the support surface (25) is flanked by side portions which are formed on the other limb (22) and form the catch fingers (38).

19. Apparatus as set forth in claim 17 or claim 18 characterised in that the catch finger (38) is enlarged in longitudinal section from its free end (36) towards the limb (22) formed thereon.

20. Apparatus as set forth in one of claims 1 through 19 characterised in that the support tool (20<sub>a</sub>) has a partial frame which is substantially U-shaped in cross-section and which comprises a back portion including the coupling rib or ribs (27), with two parallel side walls

(23), wherein a support plate (46, 46<sub>a</sub>) is arranged pivotably about an axis (A) between the side walls.

21. Apparatus as set forth in one of claims 1 through 20 characterised in that the breaking-out tool or tools (40; 41, 42) extends or extend between surfaces (34, 34<sub>a</sub>) of the support means (20, 20<sub>a</sub>, 20<sub>b</sub>, 20<sub>n</sub>), said surfaces being movable in the breaking-out direction (x).

22. Apparatus as set forth in one of claims 1 through 21 characterised in that the portion (24; 46, 46<sub>a</sub>; 64) including the support surface (25) is provided at its free edge (35) with at least one edge opening (32).

23. Apparatus as set forth in claim 21 or claim 22 characterised in that the edge opening or openings is or are disposed in opposite relationship to the free end or ends of the breaking-out tool (40, 41).

24. Apparatus as set forth in at least one of claims 1 through 23 characterised in that associated with the support surface (25) as a breaking-out tool is a pressure pin (40) with a rounded free end or a fork member (41, 41<sub>a</sub>, 41<sub>b</sub>) with one or more finger-like fork prongs (42, 42<sub>a</sub>, 42<sub>b</sub>) of preferably flat cross-section.

25. Apparatus as set forth in claim 24 characterised in that the free end of the fork prongs (42, 42<sub>a</sub>, 42<sub>b</sub>) is formed by a part-circular curve (43<sub>a</sub> in Figures 18, 23) formed therein or a tip (Figures 30, 31) formed out thereon.

26. Apparatus as set forth in claim 24 or claim 25 characterised in that the free end of the pressure pin (40) or the fork prong (42, 42<sub>a</sub>, 42<sub>b</sub>) is in the form of a rough surface.

27. Apparatus as set forth in claim 26 characterised in that the rough surface is formed by a coating (44), in particular a coating with oxides, carbides, corundum or the like.

28. Apparatus as set forth in claim 26 characterised in that the coating (44) is applied by means of thermal spraying.

29. Apparatus as set forth in claim 26 characterised in that the rough surface is formed by a coating of plastic material or rubber.

30. Apparatus as set forth in claim 26 characterised in that the rough surface is formed by irregularities provided in the surface of the pressure pin (40) or the fork prongs (42, 42<sub>a</sub>, 42<sub>b</sub>).

31. Apparatus as set forth in claim 26 or claim 30 characterised in that the surface of the pressure pin or the fork prongs (42) is roughened mechanically, chemically or electrically.

32. Apparatus as set forth in claim 30 or claim 31 characterised in that the irregularities on the pressure pin (40) or the fork prongs (42, 42<sub>a</sub>, 42<sub>b</sub>) are formed by teeth (61, 61<sub>a</sub>) formed out of same, hooks (61<sub>b</sub>) or at least one shoulder (61<sub>c</sub>).

33. Apparatus as set forth in one of claims 26 through 32 characterised in that the axial height (h) of the rough surface (44) corresponds at most to the diameter (d) of the pressure pin (40) or the width of the fork prong (42).

34. Apparatus as set forth in one of claims 24 through 33 characterised in that the fork member (41) projects from a plate-shaped

male die (56), wherein possibly the portion of the fork member (41), which is connected to the male die (56), has clamping noses (60) and/or abutments (54) (Figure 14).

35. Apparatus as set forth in one of claims 1 through 34 characterised in that shaped support portions (62) which are arranged in the opening (16<sub>a</sub>) at the edge thereof and which are fitted on to plug-in profile members (65) are disposed in mutually opposite relationship, the support portions (62) being provided with radial support lips (64) of elastic material which are directed towards each other.

36. Apparatus as set forth in claim 35 characterised by an angle portion as a shaped support portion (62), of which one limb is the support lip (64), wherein the other limb formed thereon is formed by a hollow profile portion (63), wherein possibly the shape of the hollow profile portion (63) corresponds to that of a cylindrical cup.

37. Apparatus as set forth in one of claims 1 through 36 characterised by a clip-like tool (68 through 74) which is fixed to the opening (16, 16<sub>a</sub>) and which respectively includes a frame portion (76) from which resilient support tongues (34<sub>b</sub>) project inwardly or on which at least one inwardly disposed support plate (46<sub>b</sub>) is arranged movably about a pivot axis (A).

38. Apparatus as set forth in claim 37 characterised by a frame portion (76) which is at least partially curved in plan view or by a substantially rectangular frame portion (76).